

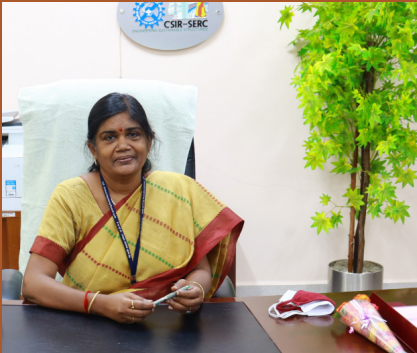
e-STRUCT

e-Newsletter of CSIR-Structural Engineering Research Centre

In this issue

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- Capacity development / Events
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- Honours, awards and recognitions

From the Director's Desk



e-Struct, the quarterly newsletter showcases the scientific activities and myriad events that are part of day-to-day life on the CSIR-SERC campus. I am very happy to present Vol. 6, No. 3, 2022 issue of e-STRUCT. This edition of newsletter showcases the varied skills of the CSIR-SERC community, highlighting our R&D pursuits, achievements, skill development initiatives and other significant events & endeavors during July-September 2022.

This issue's research highlight is about the work done on structural vibration control of Floating Offshore Wind Turbines (FOWTs). A new methodology is proposed for the optimal design of Tuned Mass Damper (TMD) for FOWT. The steps involved are the modelling and parameter estimation of a simplified model, TMD design is then formulated as a feedback control problem and the final step involves the nonlinear dynamic analysis of FOWT with the optimal TMD configuration and post-processing of results for the performance assessment of the designed TMD.

In this quarter projects undertaken include condition assessment of a 275m RC chimney in Rihand, fatigue life evaluation of alumino-thermit welded rail joints, Kanpur, design validation of a 220kv suspension and angle type concrete transmission tower in Mumbai and verification of a prestress cable profile for a girder by NDT in Ernakulam and also an MoU for condition assessment with NTPC was signed.

Under capacity development initiative three advanced courses, two online CISCO conferences (iCEN-48, 49), global battery experiment for school children and a five day mason training programmes were organised. Two special lectures were delivered by experts.

Other major events during this quarter included celebrating the World Youth Skills Day, Hindi fortnight, 81st CSIR Foundation Day, Swachh Sagar Surakshi Sagar Campaigns and Independence Day. Two COVID19 vaccination camps and the ISO Audit were successfully completed. I hope you enjoy reading the online versions of past newsletters also and learn about our research developments that stemmed from our scientific and technical teams' ingenuity and commitment to collaboration and excellence.

With best wishes

Dr N. Anandavalli



Independence Day Celebration

Research highlights

Structural vibration control of floating offshore wind turbines

The global sustainability goals can be achieved by the efficient utilization of renewable energy resources. Towards this end, the harnessing of wind energy has recently gathered a lot of attention. Based on the Global Wind Energy Council (GWEC) report, worldwide wind capacity reached about 743 GW (including both onshore and offshore wind power) in 2021. The offshore installations are more advantageous compared to onshore installations due to higher wind speed and lesser turbulence. It is expected that future installations will see a shift from shallow to deep waters. The floating offshore wind turbines (FOWTs) are supported on a floating platform in deep waters. The FOWTs are subjected to large structural vibrations due to coupled action of wind and wave loads. These loads can severely affect the fatigue life of the structure and lead to fluctuations in power generation. These loads may also induce structural failure under extreme environmental conditions. Supplemental control devices are often installed to reduce vibrations. Structural control utilizing a tuned mass damper (TMD) is an effective solution for response control of FOWT. A new methodology, shown in Figure 1, is proposed for the optimal design of TMD for FOWT. The first step involves the modelling and parameter estimation of a simplified model that reproduces the

key dynamics of the FOWT. In the second step, the TMD design is formulated as a feedback control problem. FOWT-TMD system is rearranged in a generalized-plant controller setup. The optimization problem is constructed which is solved in step three using the iterative LMI procedure (particle swarm optimization nested with convex optimization). The final step involves the nonlinear dynamic analysis of FOWT with the optimal TMD configuration and post-processing of results for the performance assessment of the designed TMD.

Framework for TMD design

The dynamics of the structure-TMD system are first rearranged in the form of a generalized plant-controller setup following the control system literature. The generalized plant consists of the primary structure and the TMD disconnected at the connection points. The controller consists of a static gain matrix represented by the stiffness and damping of the TMD. The generalized plant has two inputs — external disturbance and the TMD reaction force (note that the TMD reaction force incorporates the effect of TMD stiffness and damping. It is equal to the sum of TMD stiffness times relative displacement and TMD damping times relative velocity between the connection points). The two output of the generalized plant

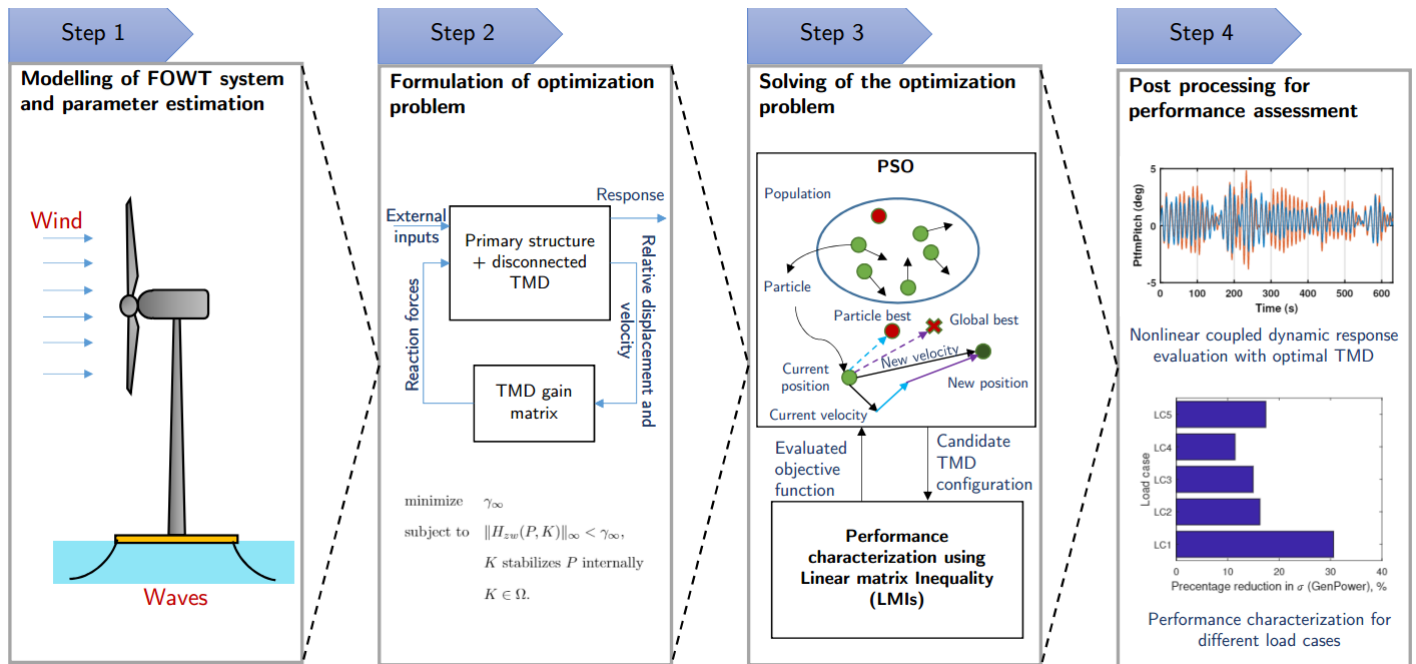


Fig.1: Figure 1: Methodology adopted for optimal TMD design

corresponds to the primary structure response and the relative displacements and velocities between the connection points of the structure and TMD. The conceptual block diagram of the framework is shown in Figure 2. The optimization problem for the TMD design can be stated as:

Find the output static-gain controller matrix such that the transfer function norm from external input to the primary structure response is minimized while ensuring the stability of the structure-TMD feedback system.

The framework can incorporate model uncertainties and physical constraints, like relative TMD displacement, for a more practical TMD configuration.

Nonlinear dynamic analysis with optimal TMD

The coupled dynamic response of the FOWT is evaluated with the optimal TMD. The mean wind speed is taken in 5m/s. The wind profile is generated using Kaimal spectra with 0.2 as the power law exponent. The significant wave height is taken as 1.99 m and the wave profile is generated using the JONSWAP spectrum. The peak spectral period is taken as 12.7 seconds.

The time domain response of the FOWT with and without optimal TMD is compared in Figure 3(a). It can be seen that TMD is effective in reducing the structural response of the FOWT. The optimal TMD is also effective in reducing the variations in the rotor speed and generated power. The

power spectral density of the tower top fore-aft displacement and platform pitch for FOWT with and without optimal TMD are compared in Figure 3(b). The power spectral density (PSD) plots reassure the effectiveness of the TMD in reducing the response of FOWT when subjected to coupled wind and wave loading.

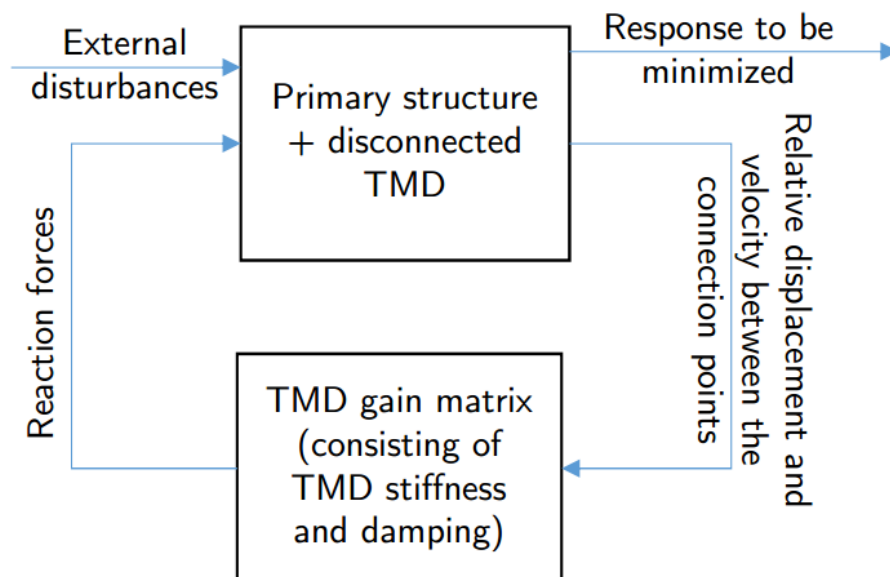


Fig.2: Conceptual diagram for optimal TMD design

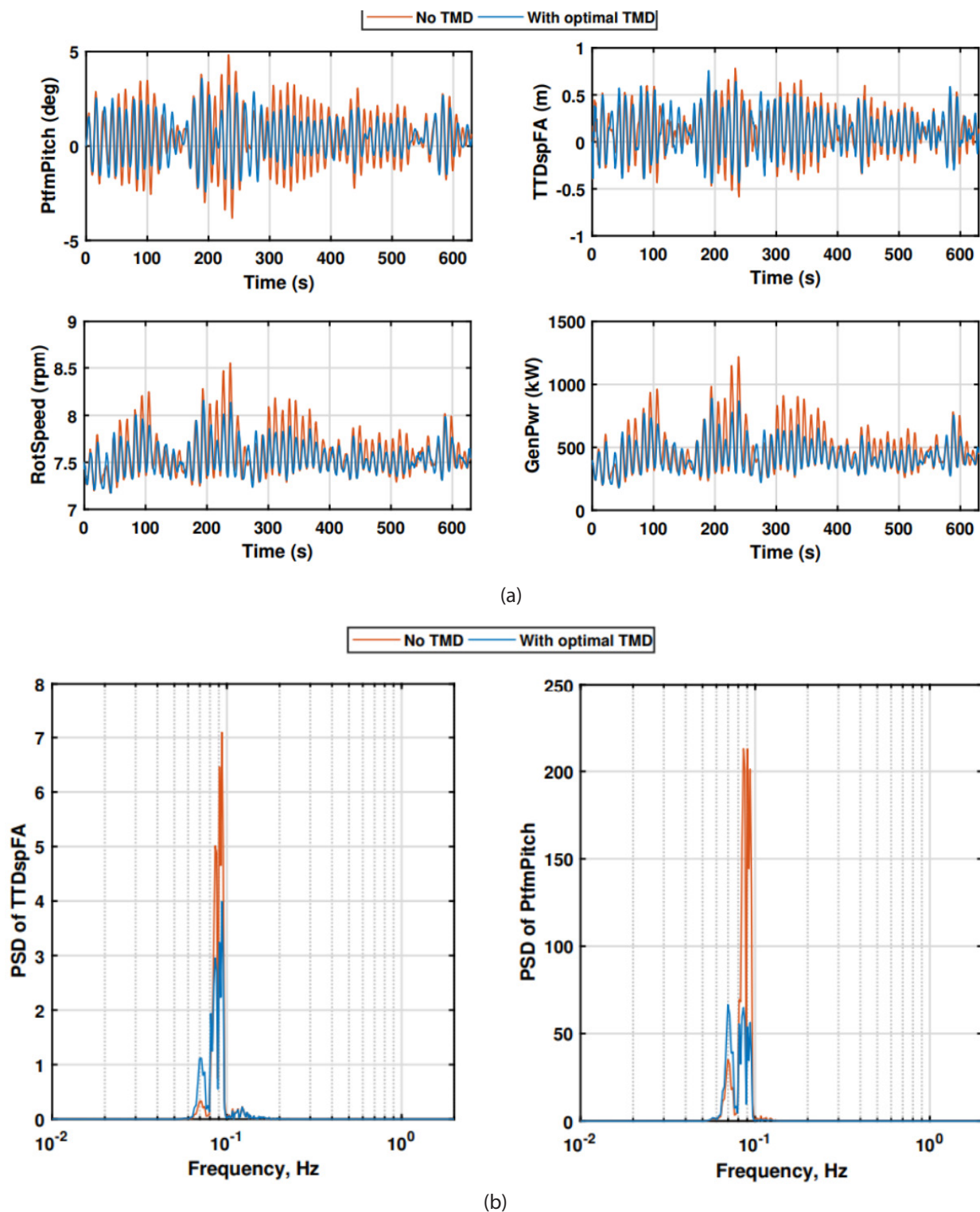


Fig. 3 : Performance assessment of the optimal TMD in – (a) time domain and (b) frequency domain

Experimental validation of the optimal TMD using real-time hybrid simulation (RTHS)

The performance of the TMD can be evaluated using real-time hybrid simulation (RTHS) as shown in Figure 3. The tower-nacelle assembly is physically tested. The TMD and aerodynamic loads are represented using a computer

model, termed a virtual substructure. The TMD and wind loads are applied to the tower-nacelle assembly using an electromagnetic shaker. A partially coupled analysis is carried out by applying the hydrodynamic forces at the base of the tower using a shake table. A prototype, representative of the tower-nacelle assembly, is fabricated for the experimental evaluation of the

TMD design methodology. A resonance search test is carried out for the dynamic characterization of the tower-nacelle assembly. The next step involves the evaluation of the optimal TMD for the prototype and its validation using RTHS.

Fig 3: RTHS configuration for TMD validation

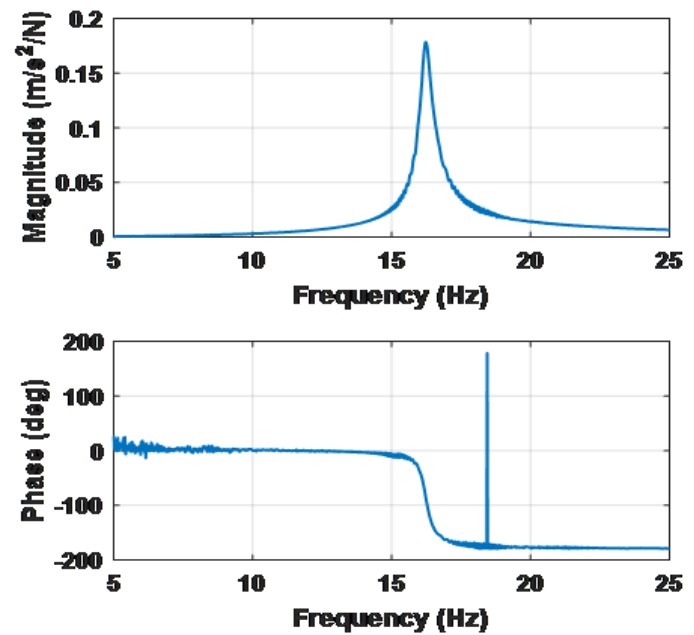
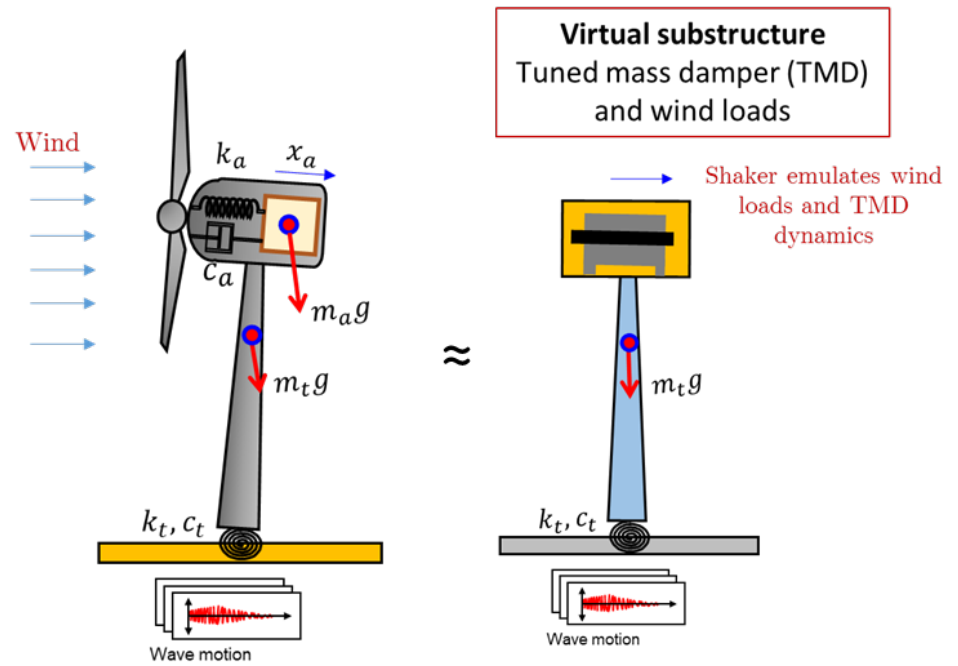


Fig. 4 Prototype tower-nacelle assembly and its frequency

Major Publications

- Ocean Engineering, 2022
- Renewable and Sustainable Energy Reviews, 2022
- Materials Today: Proceedings, 2022
- Proceedings of 6th National Symposium Shaping the Energy Future: Challenges and Opportunities (SEFCO-2022), 2022
- Proceedings of EERA DeepWind, 2022

Major Projects Undertaken

- Condition Assessment of 275m RC Chimney and Recommendation for Repair-Stage II - NTPC, Rihand
- Fatigue Life Evaluation of Alumino-Thermit Welded Rail Joints - The India Thermit Corporation Limited., Kanpur
- 220kV Suspension and Angle Type Concrete Transmission Towers including Foundation, Phase-1: Preliminary Design Validation - InDriya Power Limited, Mumbai
- Verification of Prestress Cable Profile for a Girder by NDT in ETMKTYM-CGV Section of TVC Division of Southern Railway - Chief Engineer (Construction), Southern Railway, Ernakulam

MoUs

- Memorandum of Understanding (MoU) between CSIR-SERC and National Thermal Power Corporation Limited, New Delhi for the project "Condition Assessment of Civil Structures in NTPC Power Station Situated at Different Parts of the Country" was signed on 28th September 2022.



Capacity development

Courses organized as a part of CSIR Integrated Skill Initiative

- Advanced Course on "Recent Advances in Concrete Technology & Durability of Concrete Structures (RACT&DCS-2022)" was held during 24-26 August 2022
- Advanced Course on "Microstructural Characterisation Techniques and Mix Design of Special Concretes (MCTMDSC-2022)" was held during 14-16 September 2022
- Advanced Course on "Engineering of Precast Concrete Technology for Mass Housing (EPCTMH-2022)" was held during 22-23 September 2022

Industry Meet

- iCEN-48: i-Connect event (iCEN-48) was organised online (Cisco Conference Event) on July 14, 2022 under the sub-vertical "Structural Health Monitoring Technologies for Critical Infrastructure Management" of CIE-Theme "Structural Health Monitoring"
- iCEN-49: i-Connect event (iCEN-49) was organised online (Cisco Conference Event) on July 15, 2022 under the sub-vertical "Disaster Mitigation for Various Infrastructure including Early Warning Systems for Natural Disasters" of CIE-Theme "Disaster Mitigation".

Jigyasa

- **Global Battery Experiment for School Children** - a programme was conducted by CSIR-SERC at KV IIT Madras on 22nd September 2022, 175 students, 25 teachers, and 15 volunteers participated in the program.

Skill Development

- **Five-Day Mason Training Programme:** Five days mason training program for government ITI mason trade participants was conducted between 18-22 July 2022 under the CSIR skill development initiative.

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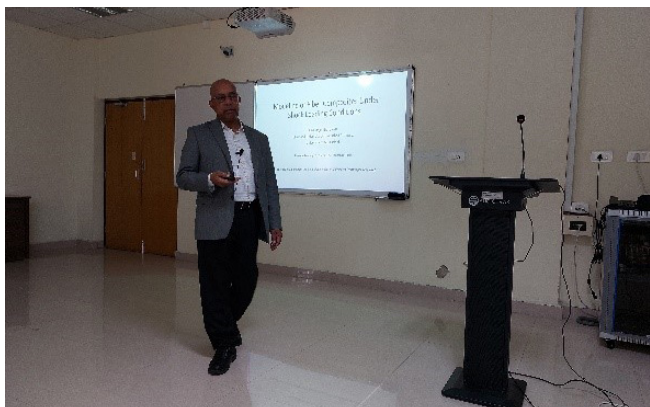


Skill Development



Special lectures

- Prof. Arunachalam M Rajendran, University of Mississippi, Oxford, USA visited CSIR-SERC on 08th August 2022 and delivered a special lecture on *"A New Woven Composite Constitutive Model Validated by Shock Wave Experiments"*



- Dr. Rishi Gupta, Professor & Special Advisor to the Dean, EDI, Department of Civil Engineering, Facility for Innovative Materials and Infrastructure Monitoring (FIMIM), University of Victoria, Canada and CEO Founder of Setu Technologies Inc., visited CSIR-SERC on 22nd August 2022 and delivered a special lecture on *"Sustainable Green Infrastructures - Potential use of Green Fiber Reinforcement in the Indian Construction Industry"*.



Events

World Youth Skills Day 2022

- Atal Innovation Mission (AIM)** in collaboration with the Council of Scientific & Industrial Research (CSIR) celebrated World Youth Skills Day – 2022 on 15 July 2022. The United Nations General Assembly in the year 2014 declared 15 July as World Youth Skills Day, to celebrate the strategic importance of equipping young people with skills for employment, decent work, and entrepreneurship. The programme was jointly organized by CSIR-Structural Engineering Research Centre (CSIR-SERC) and CSIR-Central Leather Research Institute (CSIR-CLRI) on 15 July 2022 at CSIR-SERC and CSIR-CLRI. Thirty-five students from **Pathippaga Chemmal K Ganapathy Government Higher Secondary School**, twenty-eight students from **Don Bosco Higher Secondary School** and six students from **Amrita Vidyalayam** participated in the event. Dr Shekar C. Mande, Former Director General, CSIR, was the Chief Guest of the function. Dr. Mande in his address spoke on the similar pattern of education that is followed across the world and the need for imparting practical skills that is not a part of school or college curriculum. He spoke on the importance of increasing awareness on skill requirements and the sustained role played by CSIR towards this in the country. He also spoke in detail on the job opportunities provided by CSIR by way of imparting skills to the deprived sections of the society across the nation – training people in leather research, making products out of flower waste, purple revolution at J&K, etc During the program, **IoT-based Do-It-Yourself (DIY) kits** were distributed to each student participant & their teachers. Dr G.S. Ayyappan, Senior Principal Scientist, CSIR-CSIO Unit (CMC) delivered a lecture and demonstrated the usage of IoT-based DIY kits to the student participants. Dr. P. Kamatchi, Senior Principal Scientist, CSIR-SERC delivered a lecture on the topic related to the earthquake. A science quiz & laboratory visit to Advanced Seismic Testing and Research Laboratory were also organized for the participants. Dr. Mande visited laboratories and addressed young scientists of CSIR-SERC.

World Skills Day 2022



Hindi Fortnight Celebrations - 2022

Hindi Fortnight Celebrations - 2022 commenced on 01.09.2022 with a Scientific and Technical Seminar on 01.09.2022. Scientists of CSIR labs / Instts. Located in Chennai were invited to present papers in this seminar and 15 scientists from CSIR-SERC, CSIR-CLRI and CMC presented their research papers in Hindi in this seminar. Hindi workshop was organized on 14.09.2022 through hybrid mode. Around 50 scientists participated in this workshop. Prof. Prof. C.V.R. Murthy, Indian Institute of Technology Madras, Chennai, delivered a lecture on the subject "*Earthquake Resistant Constructions are a necessity of India*" through MS Teams. Hindi Lekhan, Hindi Typing and Dictation, Antyakshari, Quiz, Hindi Pustak Pathan, Conversation in Hindi competitions were organized. Valedictory function Chief Guest Prof. (Smt.) Chitti Annapoorna, Professor and HoD, University of Madras, delivered Hindi Fortnight address. On this occasion, cash awards were presented to the officials who won prizes in the above competitions, scientists presented papers in Scientific and Technical Seminar, officials who participated in the competitions of TOLIC (Town Official language Implementation Committee, Chennai) and KSHP (Kendriya Sachivalay Hindi Parishad, New Delhi), officials participated in the "Premchand Jayanti" celebrations organized on 02.08.2022 and officials who wrote 5,000 Hindi words in day-to-day official work during the period from 01.09.2021 to 31.08.2022. A cultural programme was organized and wards of officials performed Bharatanatyam.

Premchand Jayanthi Celebration 2022

Premchand Jayanthi Celebration 2022 was successfully conducted in CSIR-SERC and CMC on 02 August 2022. Celebrations started with lighting of lamp and prayer. Dr (Ms.) N. Anandavalli, Director, CSIR-SERC and Coordinating Director, CMC delivered the Presidential Address. 25 participants took part in this programme and presented their reviews of stories and novels authored by Munshi Premchand.



81st CSIR Foundation Day Celebration

The **81st Foundation Day of CSIR**, was celebrated with great enthusiasm on 26 September 2022 and 28 September 2022, at the CSIR Campus in Taramani, Chennai by CSIR-SERC and CMC. Open Day was observed on the occasion of the 81st Foundation Day celebrations of CSIR, on 26 September 2022, at CSIR Campus, Taramani, Chennai, by CSIR-SERC and CMC comprising the regional units of CSIR-CECRI, CSIR-CEERI, CSIR-CSIO, CSIR-NEERI and CSIR-NML. Around 6500 visitors including school and college students, teachers, professionals from the industry, entrepreneurs and general public from Tamil Nadu, Andhra Pradesh and Karnataka, visited the CSIR campus and the Tower Testing & Research Station (TTRS) campus of CSIR-SERC. The foundation day function was held on 28 September 2022 at 2 PM and was presided over by Dr. N. Anandavalli, Director, CSIR-SERC and Coordinating Director, CMC. Shri U.K. Bhattacharya, Director (Projects), National Thermal Power Corporation (NTPC) Pvt. Ltd., New Delhi was the chief guest of the function. Shri Bhattacharya delivered CSIR Foundation Day Address and in his address, he lauded the efforts and contributions of CSIR in fundamental and applied research in the country. Emphasizing on the importance of knowledge in the times to come, he said that CSIR has a greater and active role to play in meeting the needs of the nation. He greatly appreciated the collaborations of CSIR-SERC and NTPC in the past and present and lauded the expertise and the active role played by CSIR-SERC in reviving the NTPC's Tapovan project.

Dr M. Ramaiah Prize for the two best technical papers published by the scientists of CSIR-SERC were presented. As a part of the function honoured the employees of CSIR-SERC and CMC, who have superannuated during the past two years. The employees who have completed 25 years of service in CSIR were also felicitated. Cash and studentship awards were also presented to the wards of the employees of CSIR-SERC and CMC for their meritorious educational achievements. **Eureka 2022** - an inter-school science quiz competition was organized on 15 September 2022 at the CSIR Campus that turned out to be a humongous success. 49 schools from in and around Chennai and Pondicherry participated in the event. **CSIR open day science competition** was held on 21 August 2022 at the CSIR campus and more than 100 students participated. Prizes were distributed for the winners of the competitions on 28 September 2022, during the foundation day function.



COVID-19 Vaccination Camp

- Eighth phase of COVID-19 vaccination camp for booster dose was arranged at CSIR-SERC campus on 22 July 2022 in co-ordination with Dr Mahesh and Dr Srilakshmi, Urban Primary Health Centre (UPHC), Velachery, Chennai. Totally 160 members (Covaxin (80) and Covishield (80)) were vaccinated in the camp
- Ninth phase of COVID-19 vaccination camp for booster dose was arranged at CSIR-SERC campus on 04 August 2022 in co-ordination with Dr Mahesh and Dr Srilakshmi, Urban Primary Health Centre (UPHC), Velachery, Chennai. Totally 47 members (Covaxin (16) and Covishield (31)) were vaccinated in the camp



Official Language Implementation Committee

139th OLIC meeting was held on 27 September 2022.

ISO Audit 9001:2015

ISO Audit of CSIR-SERC was successfully conducted by RINA, during 18-19 July 2022.

Swachh Sagar Surakshit Sagar Campaign

CSIR-SERC organized coastal cleanliness campaign under “Swachh Sagar Surakshit Sagar”. Shri. E. Ashok Kumar, Scientist, is the Nodal Officer for the “Swachh Sagar Surakshit Sagar” at CSIR-SERC. The cleanliness campaign was organized between 07.30 to 08.30 a.m. at the following avenues

1. 06th August 2022 at Marina Beach, Chennai.
2. 13th August 2022 at Besant Nagar Beach, Chennai.
3. 20th August 2022 at Thiruvanmiyur Beach, Chennai.
4. 17th September 2022 at Marina Beach, Besant Nagar Beach and Thiruvanmiyur Beach, Chennai.

Independence Day Celebration

Independence Day was celebrated on 15 August 2022. Dr (Ms.) N. Anandavalli, Director, CSIR-SERC and Coordinating Director, CMC hoisted the National flag in CSIR-SERC & TTRS, and delivered the Independence Day Speech.

Observance of Sadbhavana Diwas

“Sadbhavana Diwas 2022” was observed in CSIR-SERC and CMC a pledge was administered on 19th August 2022.



Invited talk/lecture

- Dr (Ms.) N. Anandavalli, Director, CSIR-SERC, delivered inaugural address/opening remarks and Guest of Honour speech in the i-Connect event theme "*Waste to Wealth*" (online - Cisco Conference Event) organised by CSIR-AMPRI, Bhopal on 05 July 2022, 07 July 2022 and 14 July 2022
- Dr K.N. Lakshmikandhan delivered a lecture on "*Toilet unit using thin precast concrete segmental panels*", the i-Connect event theme "*Waste to Wealth*" (online - Cisco Conference Event) organised by CSIR-AMPRI, Bhopal on 7th July 2022
- Dr (Ms.) N. Anandavalli, Director, CSIR-SERC, delivered a Guest of Honor speech in the i-Connect event theme "*Robotics for Civil Infra Inspection & Manufacturing*" (online - Cisco Conference Event) organised by CSIR-CMERI, Durgapur on 08 July 2022
- Dr (Ms.) N. Anandavalli, Director, CSIR-SERC, delivered an inaugural address/opening remarks in the i-Connect event theme - "*Safe, Smart & Sustainable Mobility*" (online - Cisco Conference Event) organised by CSIR-CRRI, New Delhi on 08 July 2022
- Dr M.B. Anoop delivered a talk on '*Uncertainty Handling using Nonprobabilistic Methods – Interval Analysis and Convex Sets*' at High-End Workshop on Advanced Techniques for Uncertainty Modelling and Quantification in Civil Engineering, NIT Tiruchirappalli on 18 July 2022
- Dr M.B. Anoop delivered a talk on '*Uncertainty Handling using Nonprobabilistic Methods - Introduction to Fuzzy Sets*' at "High-End Workshop on Advanced Techniques for Uncertainty Modelling and Quantification in Civil Engineering" at NIT Tiruchirappalli on 18 July 2022
- Dr S. Bhaskar delivered an invited talk titled '*A review on performance based specifications towards concrete durability*' for the "fib days 2022" - an event organized by The IMC-fib committee of The Institution of Engineers (India) together with fib (International) at Sir R N Mookerjee Auditorium, Kolkata on 12th September 2022
- Dr K.N. Lakshmikandhan delivered a guest and special lecture on "*Concrete quality control in construction and products for future*" for the Engineer's day celebration at Sri Chandrasekharendra Saraswathi Viswa Mahavidyalaya, Enathur on 15th September 2022
- Dr (Ms) P. Prabha delivered an invited lecture on the topic "*Use of high strength steel in construction – An Overview from R&D point of view*" in a one-day seminar on "Use of high strength steel & solutions for construction", organized by INS DAG, Kolkata, 22nd July 2022
- Dr (Ms.) N. Anandavalli, Director, CSIR-SERC, delivered inaugural address in "SRUJAN'22 - a national level symposium" organized by SRM Institute of Science and Technology, Chennai, on 22 September 2022
- G.S. Palani delivered an invited lecture "*Testing and Evaluation of Transmission Line Towers - Need & Challenges*", at a workshop on "Resilience of power and allied lifeline infrastructure systems" held at IIT, Gandhinagar on 26th September 2022
- Dr (Ms.) N. Anandavalli, Director, CSIR-SERC, presented talk on '*Infrastructure*' under the theme "*Industry and Infrastructure - materials for global society*" in the Science Summit at the 77th United Nations General Assembly (UNGA77)" on 28 September 2022 (through MS Teams)

Industrial visit

- A total of 73 students and 4 faculty members (B.E. Civil Engineering) from Sri Sairam Engineering College and Sri Venkateswara College of Engineering, Sriperumbudur visited our campus on 18th August 2022 and 6th September 2022 respectively.
- A total of 154 students and 4 faculty members (B.E. Architecture) from MEASI Academy of Architecture, Chennai visited our campus on 5th, 15th, 16th and 20th September 2022, in four batches.

Honours, awards & recognitions

- CSIR-SERC received **"Certificate of Appreciation"**, issued by Central Board of Indirect Taxes and Customs, for prompt filing of returns and payment of Goods and Services Tax up to the year ending 31 March 2022, thereby substantially contributing to building a strong and resilient nation in July 2022
- Dr (Ms.) N. Anandavalli, Director, CSIR-SERC, have been elected as **Fellow of the Indian National Academy of Engineering (INAE)** in recognition of distinguished contributions to the profession of "Engineering and Technology". The fellowship will be effective from November 1, 2022
- Dr Ing. Saptarshi Sasmal, Sr. Principal Scientist, have been elected as **Fellow of the Indian National Academy of Engineering (INAE)** in recognition of distinguished contributions to the profession of "Engineering and Technology". The fellowship will be effective from November 1, 2022
- Dr (Ms.) N. Anandavalli, Director, CSIR-SERC, was the Chief Guest of the function and delivered a special talk to the **Event of IEI Engineers Day Celebration** in IGCAR, Kalpakkam, on 23 September 2022
- Dr Mohit Verma, Senior Scientist, was awarded the **Institution of Engineers (India) Award 2021-22**
- Dr B.S. Sindu, Senior Scientist, was awarded the **Institution of Engineers (India) Award 2021-22**
- Dr Ing. Saptarshi Sasmal, Senior Principal Scientist, was appointed as the **DAAD Research Ambassador in Engineering** for 2022-2025 to promote higher education and research in Germany
- Shri. E. Ashok Kumar, Scientist, was nominated as a Nodal Scientist at CSIR-SERC to the **STEM Initiative program**, of Department of School Education, Government of Tamilnadu.

Deputations

- Shri. Subhajit Das and Shri. Nitin Khandelwal were deputed to attend the Induction Training Programme for the Newly Recruited Scientists at CSIR-HRDC, Ghaziabad, Place at (CSIR-IICB), Kolkata on 11-16 July 2022
- Dr S. Bhaskar and Dr M. B. Anoop attended the Training Programme on Managing Technology Value Chains for Directors & Division Heads at the Administrative Staff College of India, Hyderabad on 25-29 July 2022
- Dr Mohit Verma and Dr J. Venkatesan attended the Training Programme on Role of Technology in Community Level Disaster Mitigation for Scientists & Technologists working in the Government sector at the Centre for Disaster Management (CDM), Lal Bahadur Shastri National Academy of Administration (LBSNAA), Mussoorie on 25-29 July 2022
- Dr N. Sudhakar and Ms. P. Priya Hands-attended the Workshop on How To Upload Data/Work Report on E-Pronnati Organized by CSIR HQ on 17-18 August 2022 at CSIR-NGRI, Hyderabad
- Dr J. Venkatesan attended the 13th International Symposium on Plasticity and Impact Mechanics organized by the Department of Aerospace Engineering, Indian Institute of Technology Madras from 21-26 August 2022 at IIT Madras Chennai
- Dr K. Sathish Kumar and Shri. Anish Ahmad Pasha attended the Training/ Awareness Programme for PME Scientists/ Financial Officials of CSIR Laboratories organized by CSIR-HRDC jointly with the Central Planning Directorate, CSIR from 25-26 August 2022 at CDRI Lucknow
- Dr K. Senthil Kumar and Dr Mohit Verma participated in the 6th National Symposium on Shaping the Energy Future: Challenges & Opportunities at CSIR-IIP, Dehradun, Uttarakhand (SEFCO - 2022) from 26-27 August 2022 at CSIR-IIP
- Dr J. Prawin participated in the International Conference on Imaging NDE (ICINDE2022) organized by The American Society for Non-Destructive Testing (ASNT) Section from 26-27 August 2022 at Chennai
- Dr M. Surendran participated (online) in the 2nd International Conference on Computations for Science and Engineering at Universita Di Bologna, Italy from 30th August – 2nd September 2022

Deputations

- Dr M. Surendran participated (online) in the 2nd International Conference on Computations for Science and Engineering at Universita Di Bologna, Italy from 30th August – 2nd September 2022
- Dr B. Arun Sundaram attended the DST Sponsored Training Programme on Science Administration and Research Management at the Administrative Staff College of India, Hyderabad from 5-16 September 2022
- Shri. G. Ramesh Babu and Dr M. Saravanan attended the DST Sponsored Training Programme on Building Competencies for Personal Excellence at The Art of Living Centre, Bengaluru from 5-9 September 2022
- Dr N. Sudhakar, Shri. M.A. Kamsar Chinnappan and Shri.V. Mahendran attended the Workshop on Corporate Connect Programme (CCP) on TDS/TCS under Income Tax Act 1961 at the Rajiv Gandhi National Institute of Youth Development, Sriperumbudur, Tamil Nadu on 16th September 2022
- Ms. Chitra Sankaran and Mr. J. Prakashvel attended the DST Sponsored Training Programme (online) on Capacity Building Programme for Technical Personnel from September 19-30, 2022

Paper Publications

- SCI Journals - 8
- Reputed Indian Journals - 7



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